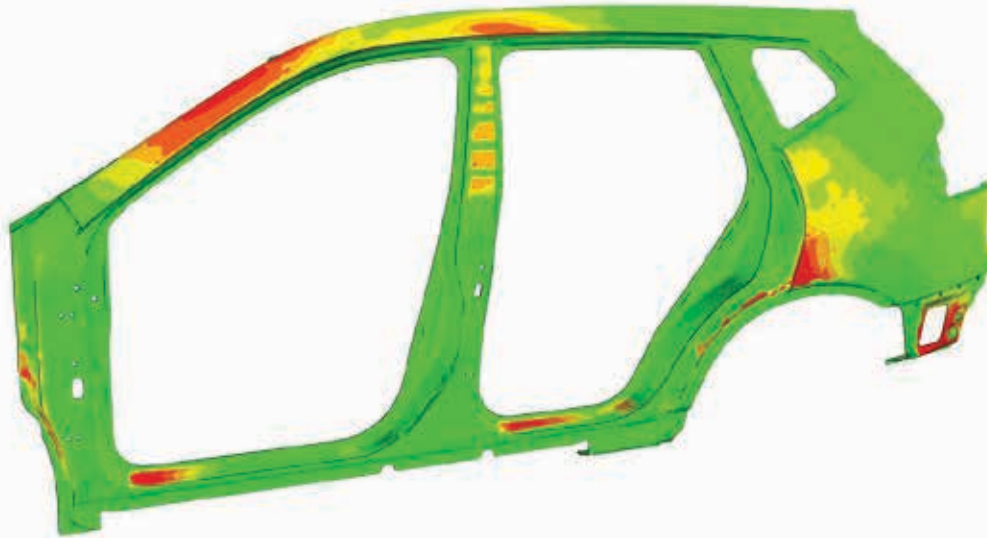


# Eliminating physical clamping processes with the aid of Engineering Simulation



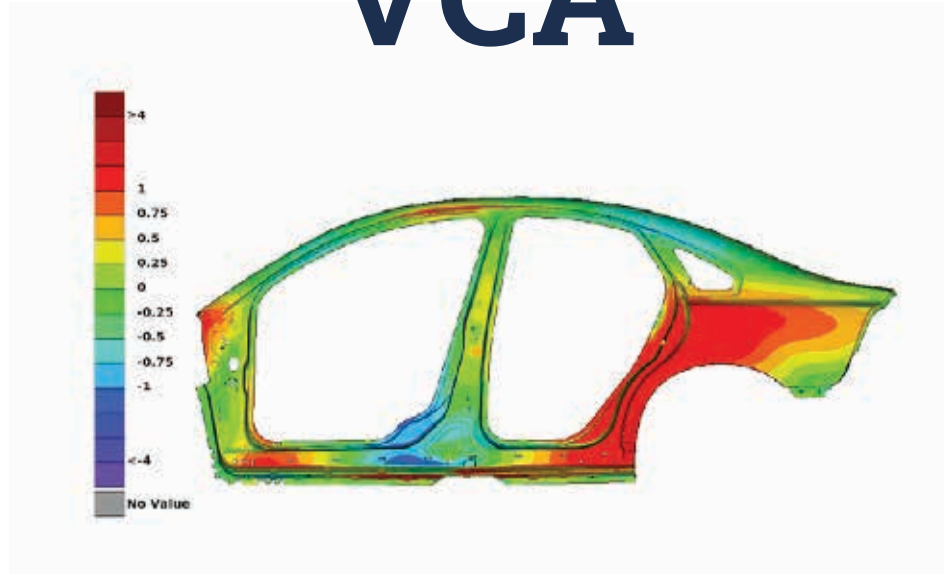


## Introduction for a new solution

- Expensive in general
- Limited repeatability
- Functional problems

# Virtual Clamping

## VCA

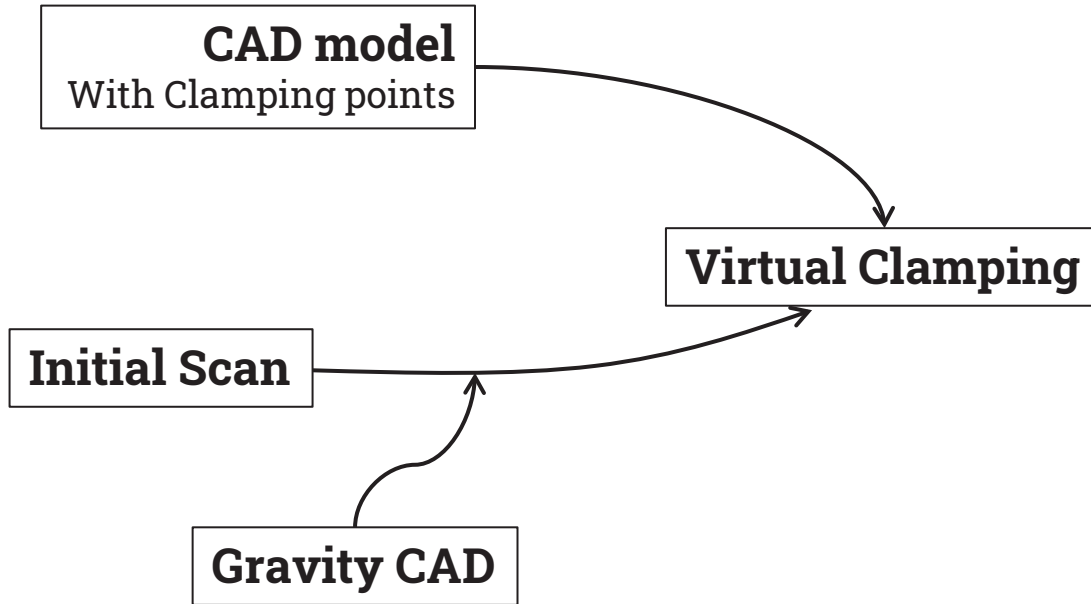


**BETA**<sup>B</sup>  
SIMULATION SOLUTIONS

**ANSA**<sup>B</sup>  
PRE PROCESSOR

**EPILYSIS**<sup>B</sup>  
SOLVER

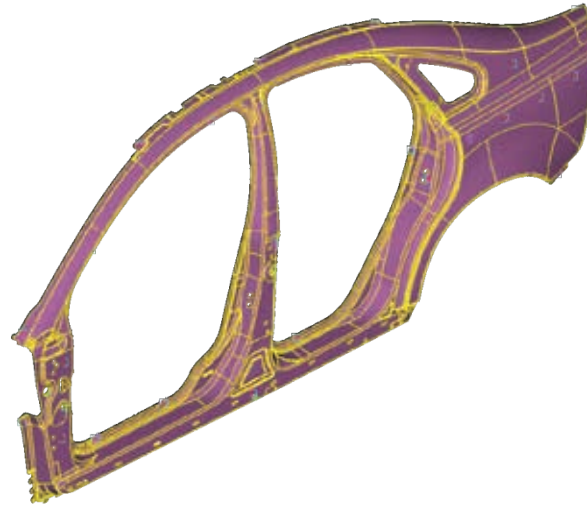
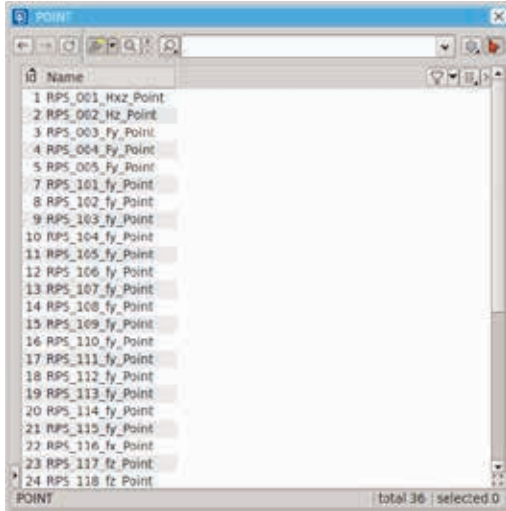
**META**<sup>B</sup>  
POST PROCESSOR



## VCA Process

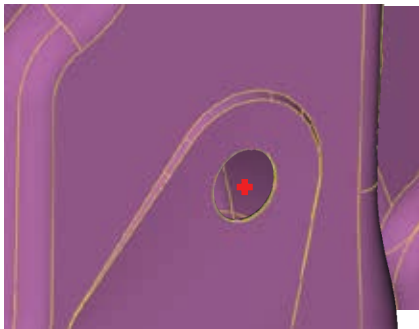
1. Imports the designed CAD model
2. Imports the scanned model
3. Adds loadcase on Scan
4. Generate the result

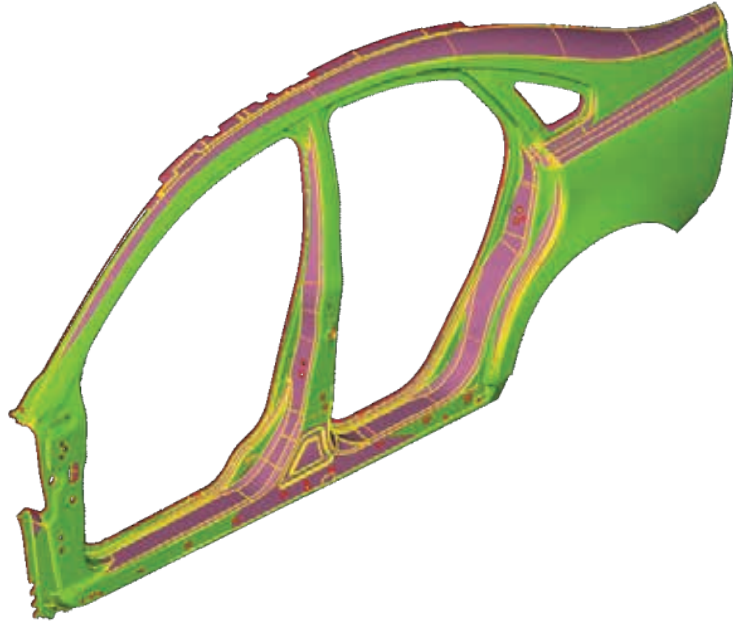
# VCA Process / 1. Import CAD model



## Import CAD model

- 3D and skin representation
- Clamping points:
  - Surface
  - Holes

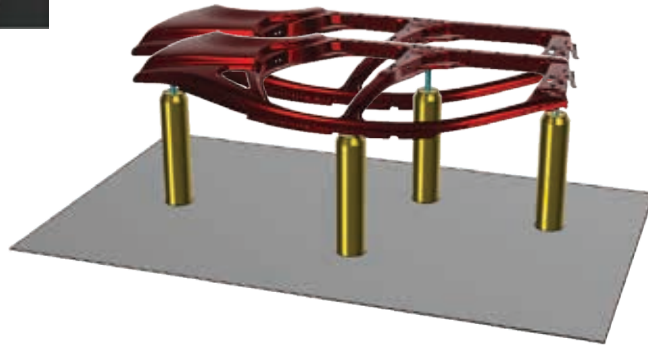
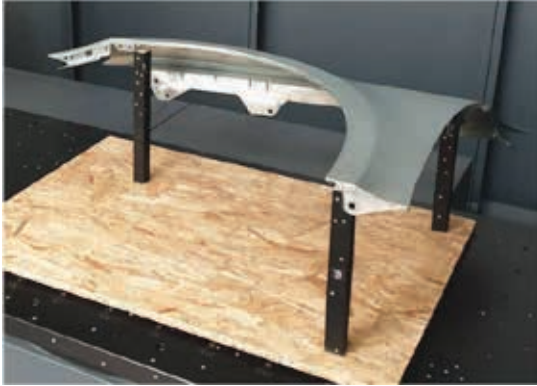




## VCA Process

1. Imports the designed CAD model
2. Imports the scanned model

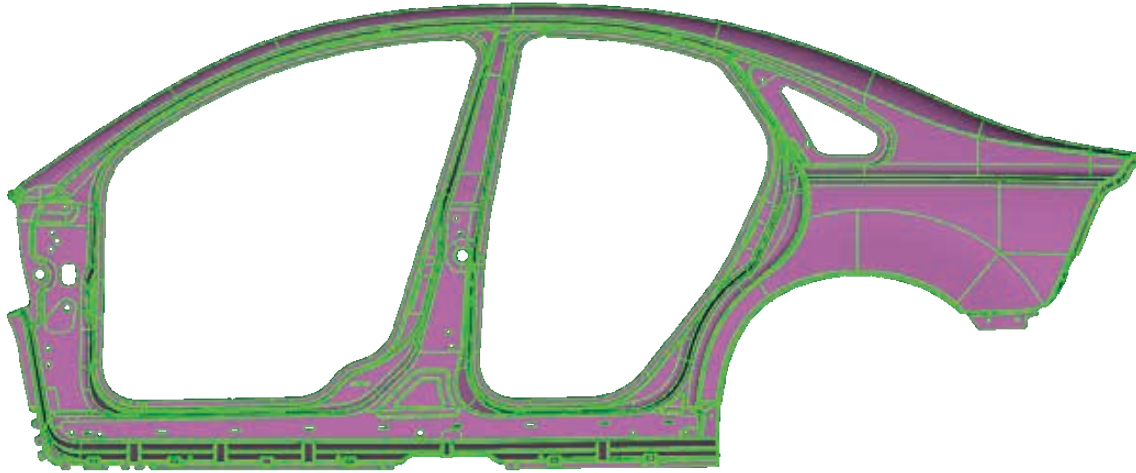
## VCA Process / 2. Import Scan



### Initial Scan

- Scan the part in a “free state”
- Simple adjustable fixture design
- 3 or more mounting points

## VCA Process / 2. Import Scan



## Positioning

- STL Positioning using the 3-2-1 scheme
- Projections on the scan
- Methodical process repeatability



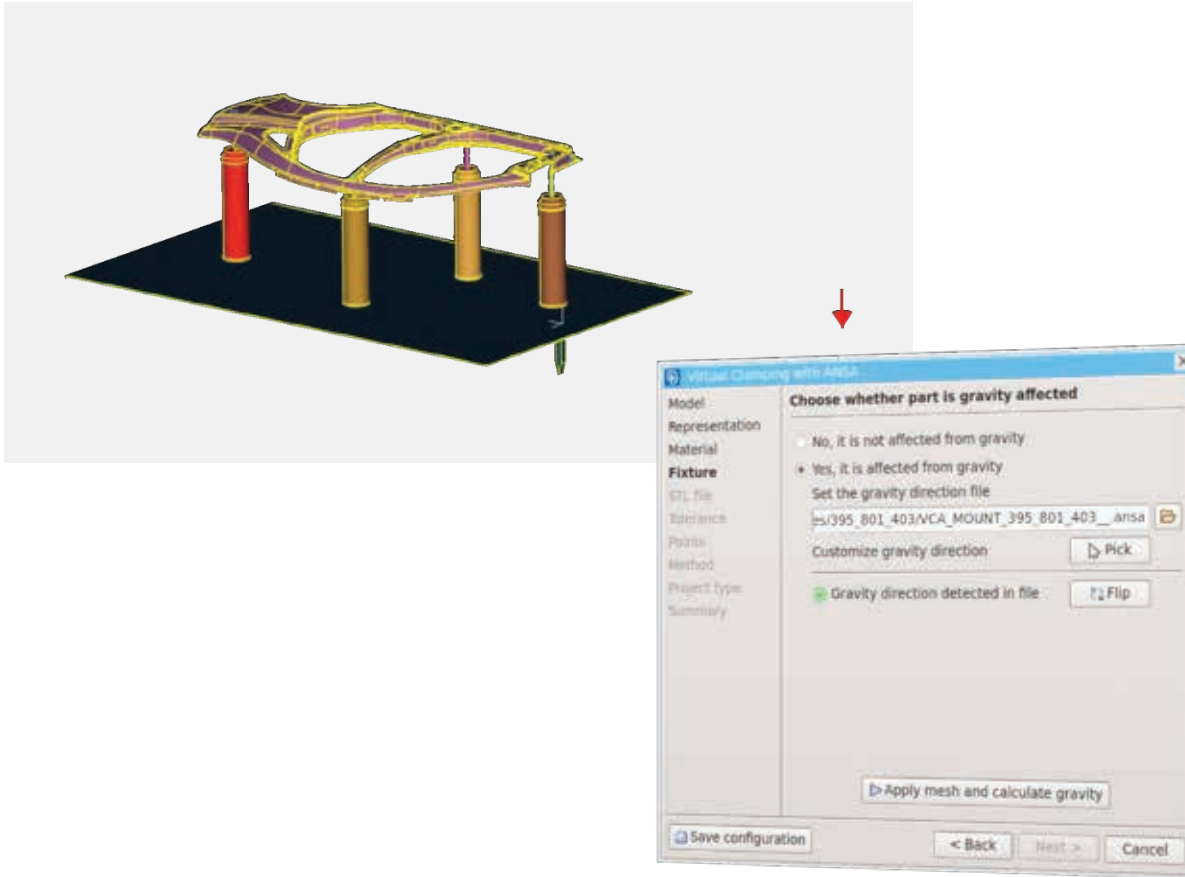
## VCA Process / 2. Import Scan



### Gravity effect

- Influence of gravity during scanning
- Import the gravity/scan set-up
- Add loadcase items
- Remove gravity effect from the scan

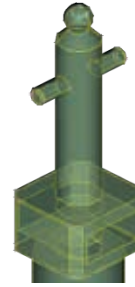
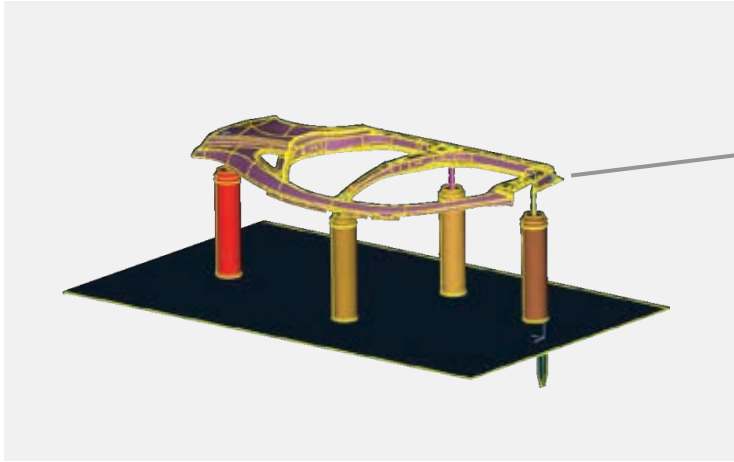
## VCA Process / 2. Import Scan



## Gravity effect

- Influence of gravity during scanning
- Import the gravity/scan set-up
- Add loadcase items
- Remove gravity effect from the scan

## VCA Process / 2. Import Scan



### Gravity effect

- Influence of gravity during scanning
- Import the gravity/scan set-up
- Add loadcase items
- Remove gravity effect from the scan

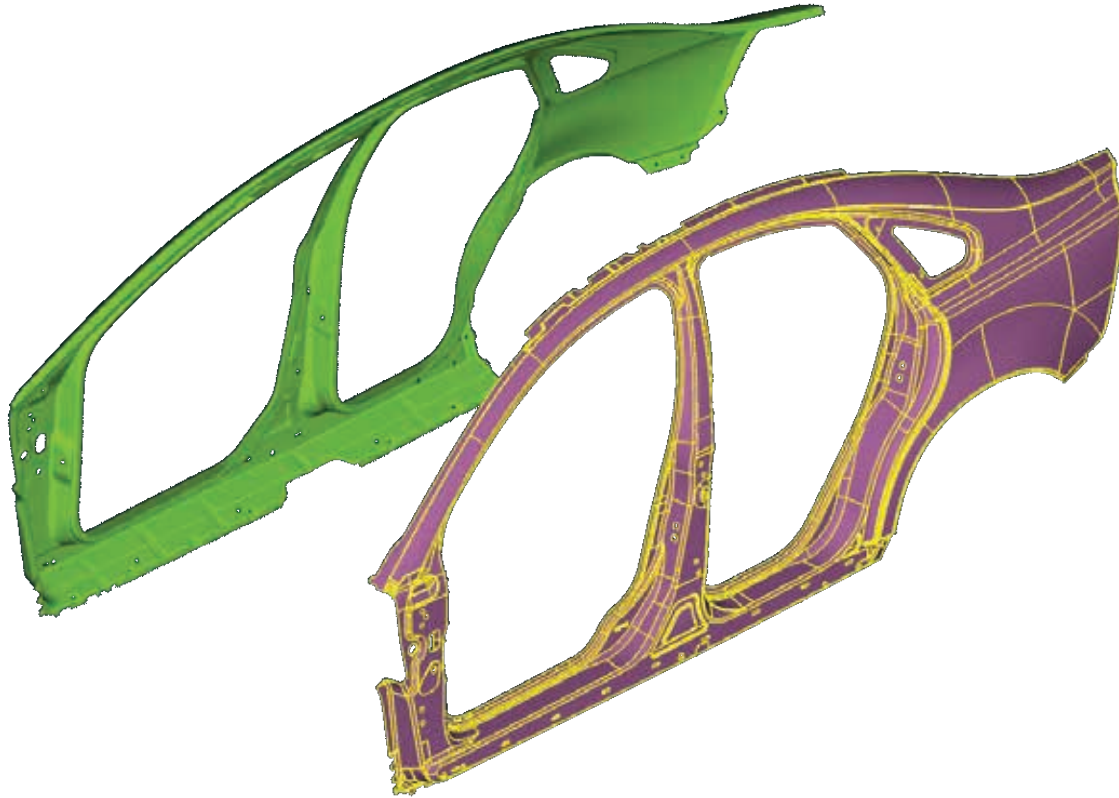


Initial Scan



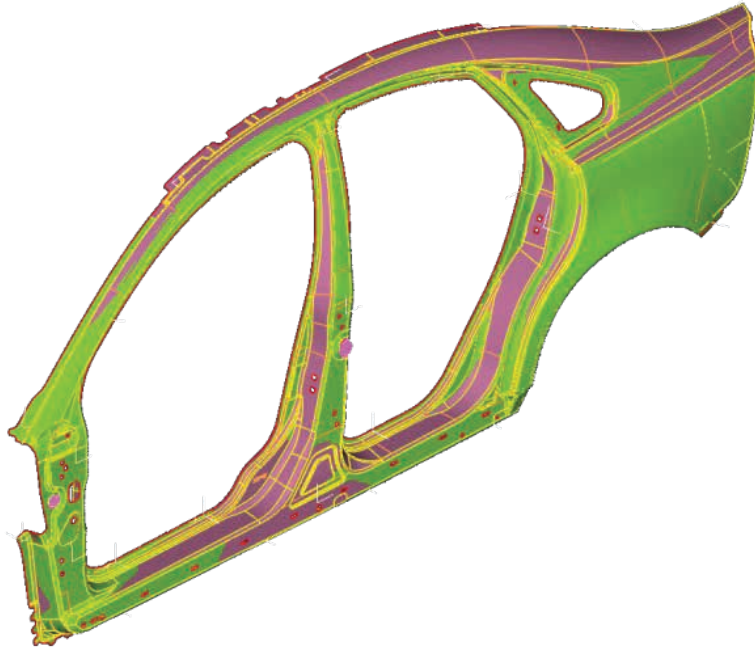
Gravity effect  
removed

## VCA Process / 2. Import Scan



### Symmetry scans

- Mirrored Scan parts can be used.
- It is specified after the STL input.



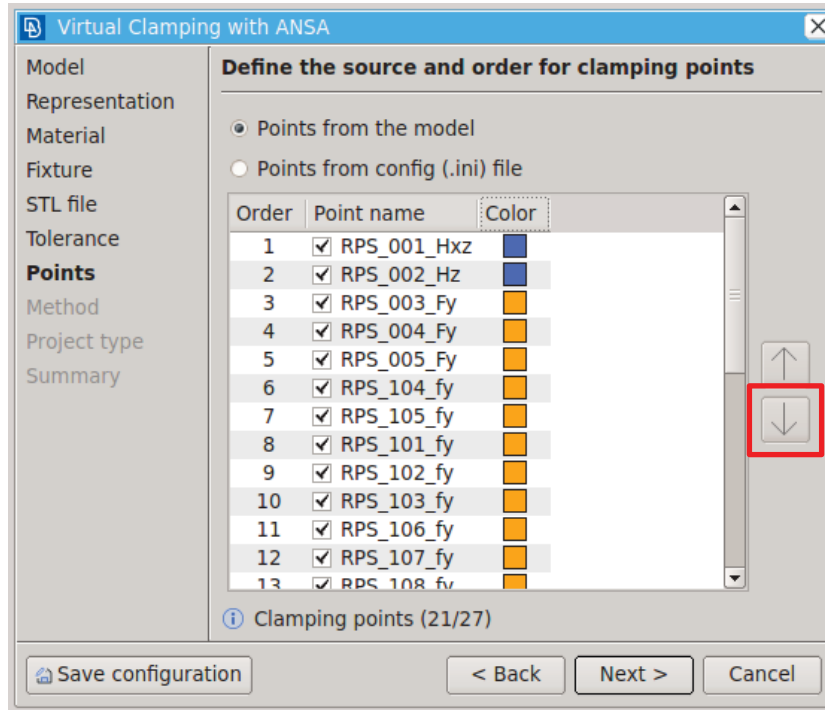
## VCA Process

1. Imports the designed CAD model
2. Imports the scanned model
3. Adds loadcase on Scan

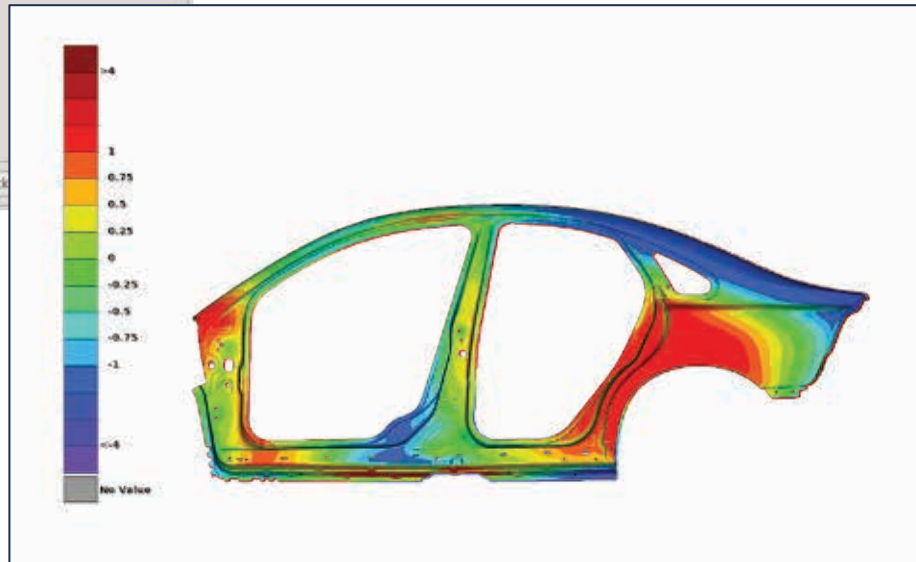
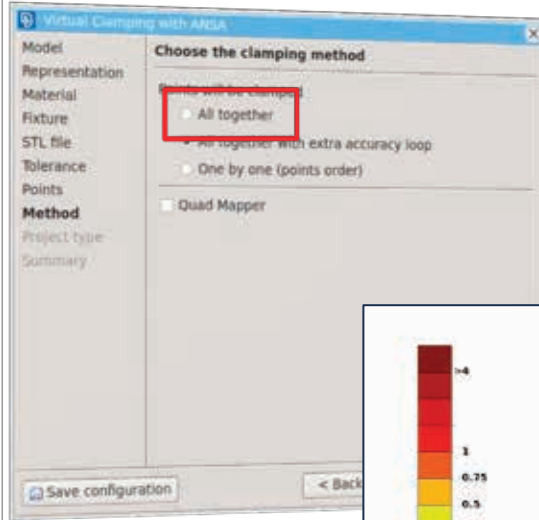
# VCA Process / 3. Add Loadcase

## Clamping points

- Change the clamping sequence



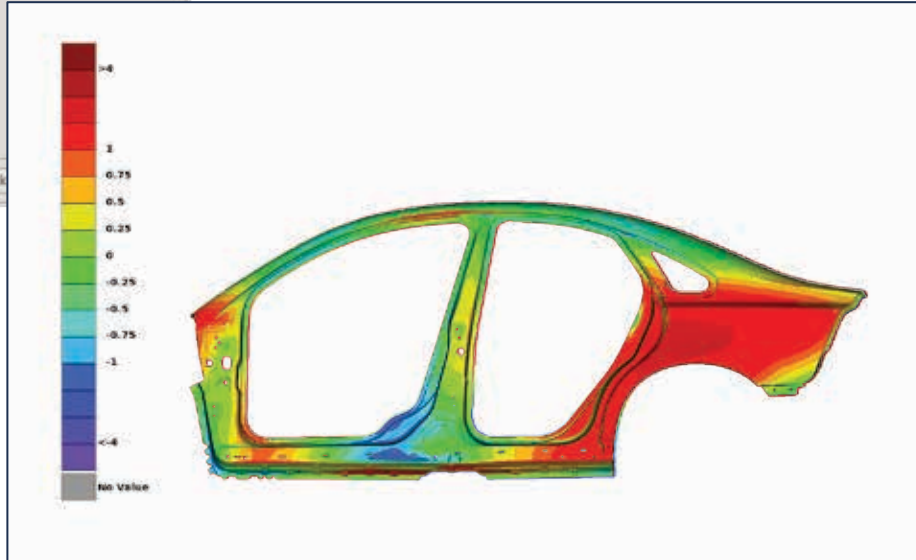
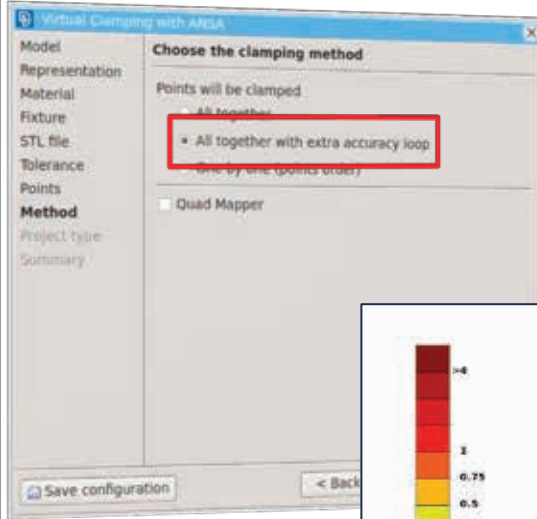
# VCA Process / 3. Add Loadcase



## Clamping method

1. All together

# VCA Process / 3. Add Loadcase

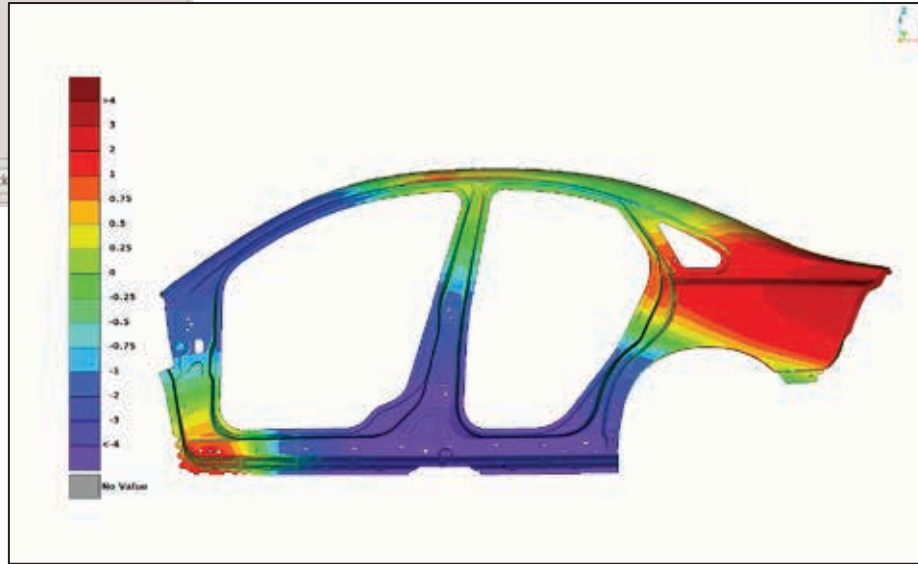
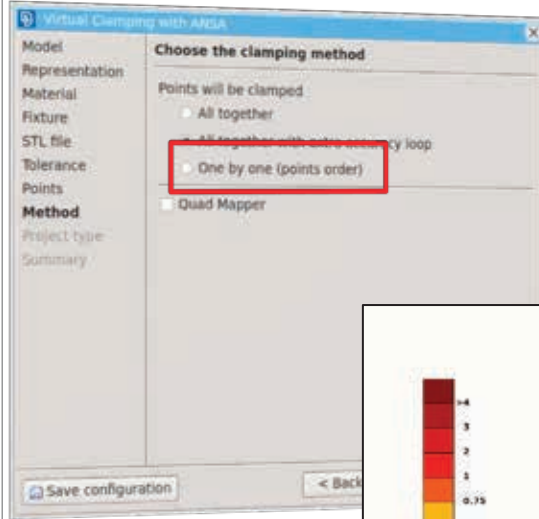


## Clamping method

1. All together
2. Accuracy Loop



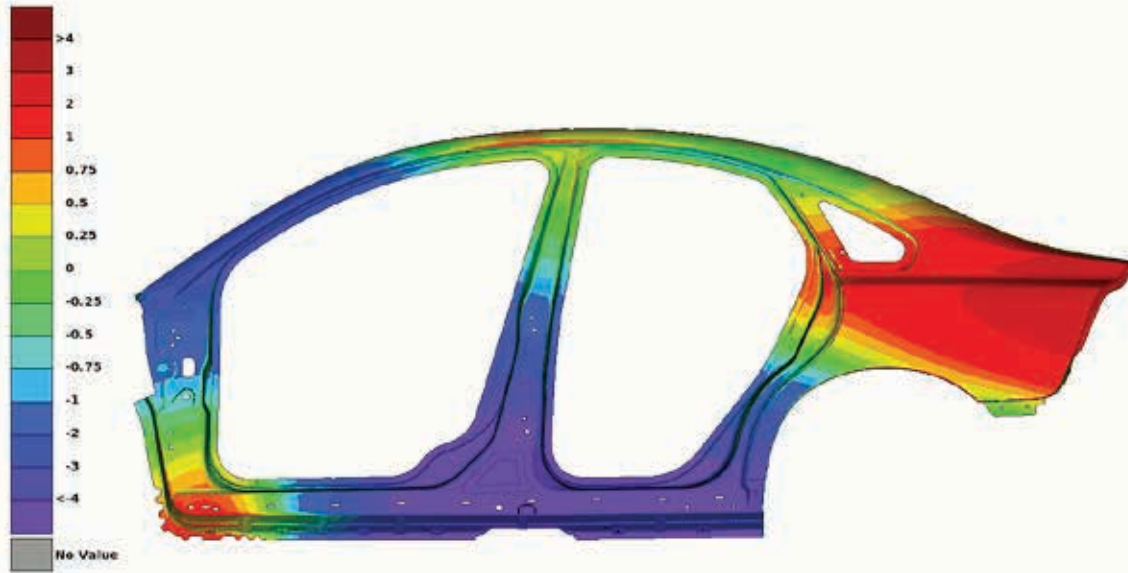
# VCA Process / 3. Add Loadcase



## Clamping method

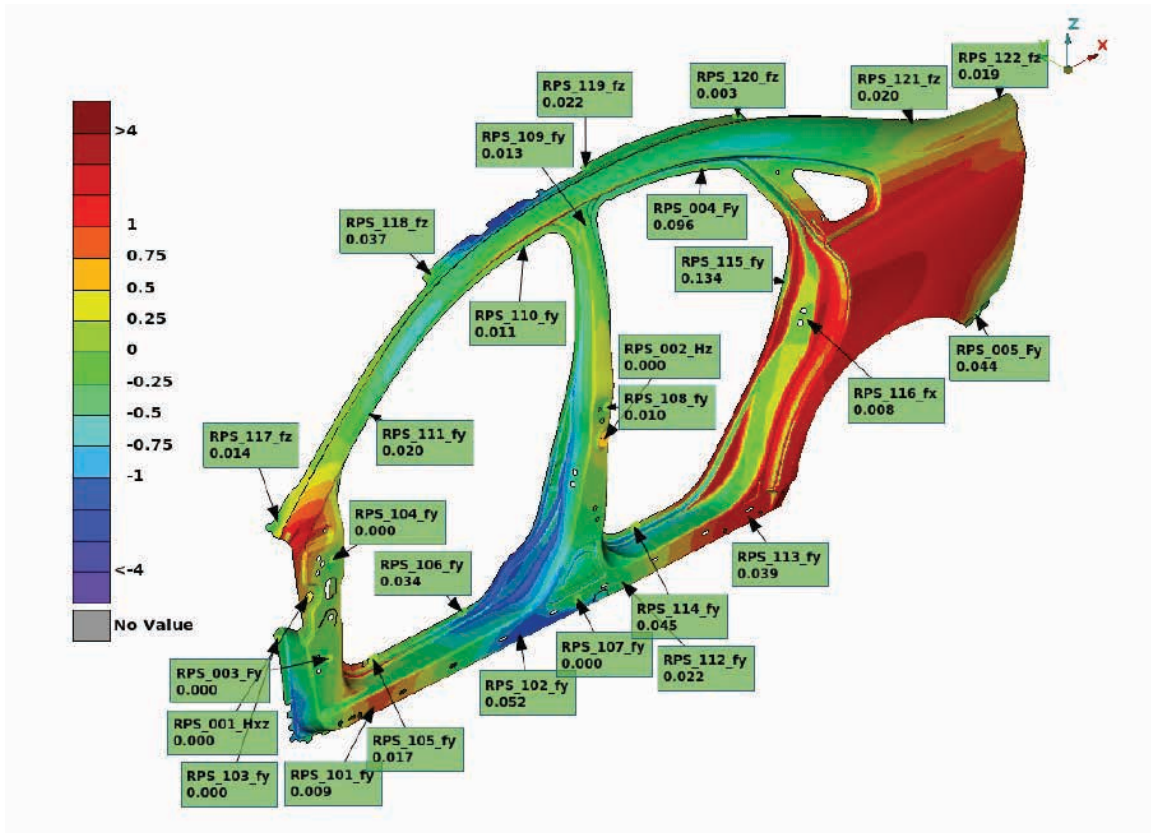
1. All together
2. Accuracy Loop
3. One by one

## VCA Process / 3. Add Loadcase



## Clamping method

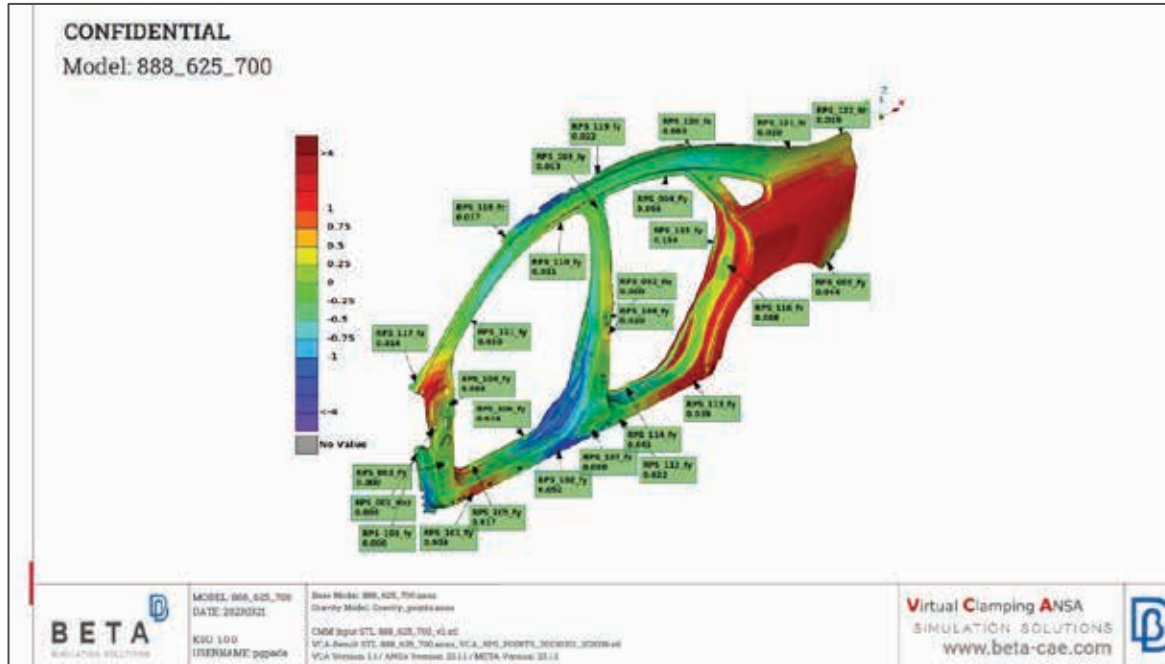
- All together
- Accuracy Loop
- One by one



## VCA Process

1. Imports the designed CAD model
2. Imports the scanned model
3. Adds loadcase on Scan
4. Generate the result

# VCA Process / 4. Result



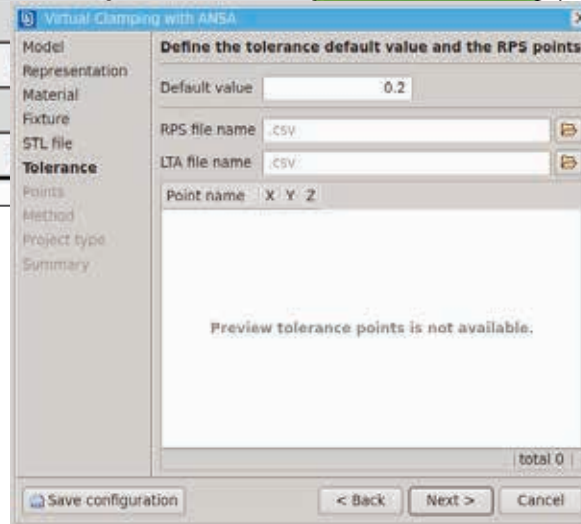
## Output

- Result STL file(s)
- Comparison PDF file
- Configuration file.

# VCA Process / 4. Result

Model: 888\_625\_700

RPS Point	Disp X	Disp Y	Disp Z	Disp Total	Force Applied (N) (w common materials)	INITIAL /Actual-solved X   Y   Z   DIAM	TOLERANCE
RPS_001_Hxz	-1.6393	2.7031	-0.5486	3.2086	66.1812	0.2-0.2/0.2-0.2/0.2-0.2/0.0 0.0	0.0000/-0.4380/-0.0001/0.0000
RPS_002_Hz	-2.3871	-4.6022	9.3645	10.7039	22.8039	0.2-0.2/0.2-0.2/0.2-0.2/0.0 0.0	0.1624/-0.3467/0.0001/0.0000
RPS_003_Fy	0.1768	-4.0869	-0.1962	4.0954	15.8216	0.2-0.2/0.2-0.2/0.2-0.2	0.0000/0.0003/0.0000/0.0003
RPS_004_Fy	4.0720	3.6289	17.2152	18.0586	112.0018	0.2-0.2/0.2-0.2/0.2-0.2	-0.0042/0.0938/-0.0562/0.1111
RPS_005_Fy	-0.5838	12.2266	21.5182	24.7561	1.7716	0.2-0.2/0.2-0.2/0.2-0.2	0.0142/-0.0444/-0.0005/0.0466
RPS_101_fy	3.0911	3.4524	3.3782	5.7300			
RPS_102_fy	3.0801	-1.8602	5.0148	6.1721			
RPS_103_fy	-1.4052	2.3355	-1.1685	2.9656			
RPS_104_fy	-2.0505	3.5295	-0.0237	4.0820			



## Output

- Result STL file(s)
- Comparison PDF file
- Configuration file.

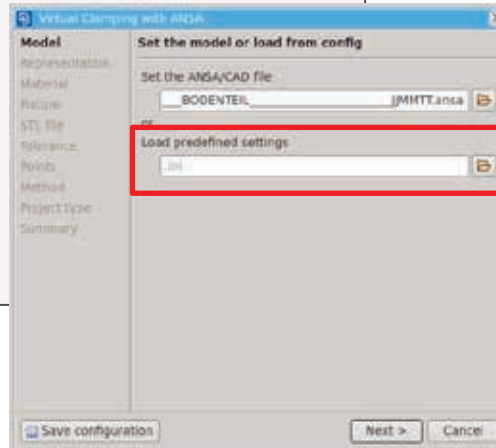
# VCA Process / 4. Result

```
[VCA Configurations]
version = 1.1

[Attributes]
model_file_name = /home/pgpada/Desktop/395_801_403_001_TMG_017_B00ENTEIL_JJMHTT.ansa
user_representation = Skin
material_modulus = 70000
material_density = 2.7e-09
material_poisson = 0.34
material_thickness = 1.0
gravity_affected = True
gravity_file_name = /home/pgpada/Desktop/VCA_MCUNT_395_801_403_ .ansa
stl_file_name = /home/pgpada/Desktop/395_801_403_001_TMG_017_B00ENTEIL_JJMHTT.stl
stl_mirrored = False
tolerance_default = 0.2
clamping_method = All together with extra accuracy loop
quad_mapper = False
company = BETA
classification = Confidential
security_level = 1.0.0

[Clamping points]
RPS_001_Fz = True
RPS_002_Fz = True
RPS_003_Fz = True
RPS_004_Rx = True
RPS_021_fy = False
RPS_022_fy = False
RPS_023_fy = False
RPS_024_fy = False
RPS_101_fz = True
RPS_102_fz = True
RPS_103_fz = True
RPS_104_fz = True
RPS_105_fz = True
RPS_106_fz = True

[Meta data]
AKSA_version = 22.1.3
```



## Details

- A configuration file is automatically saved at the end of the process.
- The user can access the file edit it and reuse it.

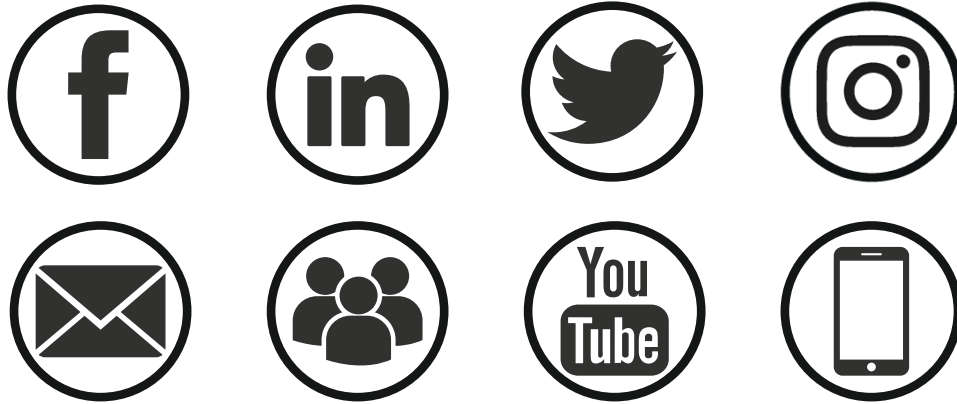
## VCA Process Benefits

- **Designed for non-ANSA users**
- **Reduces expenses for the creation of clamping devices**
- **One adjustable fixture is needed for all parts**
- **Reduces set-up time of the scan procedures**
- **Quick evaluation of additional clamping scenarios**
- **Works with all scanner devices**

## VCA Process Next Steps

- **Addition of Tailored blank parts, with multiple materials and thicknesses**
- **Assembly of multiple clamped parts**
- **Optimization of the clamping sequence and positions, to reduce final displacements**
- **Implementation in Komvos software**
- **Addition of an external solver for thermal simulations**





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